

FITTING INSTRUCTIONAL SYSTEMS DESIGN MODELS WITH WBLE PLANNING: THE CASE OF DICK, CAREY & CAREY MODEL

Raja Maznah Raja Hussain, Ph.D

Abdullatif Ismail

University of Malaya

rmaznah@gmail.com

ismail.abdullatif@gmail.com

Web-Based Learning Environment (WBLE) has been developed based on various instructional design models (systematic, cognitive and constructivist models, etc.). However, literature reveals on a controversial issue concerning the authenticity of some of these models toward WBLE planning. This article is intended to discuss the case of using the instructional systems design in planning WBLE. The Dick, Carey and Carey (2005) Model was chosen as a sample study. Finally, the paper concludes with a discussion of further research issues.

Keywords: Web-Based Learning Environment (WBLE), Web-Based Instructional Design (WBID), Instructional Design (ID), E-Learning (EL), Distance Learning (DL).

Web-Based learning environments (WBLE) have been planned based on different developmental approaches such as the instructional systems design (Dick & Carey, 1978-1996; Dick et al., 2001-2005), cognitive flexibility theory (Spiro, Feltovich, Jacobson, & Coulson, 1991), and constructivist learning environment (Jonassen, 1999).

Davidson-Shivers and Rasmussen (2003) argued that the traditional ID models such as Dick, Carey and Carey's model and others are typically set for designing and developing at the micro level. Micro level design is the planning and developing at the lesson, unit or course level.

Dargan (2003) criticized the instructional systems design mainly in respect to designing WBLE and contended that "neither Dick and Carey nor Smith and Ragan addressed web-based learning or how the instructional design model is affected by the use of the Internet to deliver or supplement instruction" (p. 4). However, other researchers have generally criticized the developmental approaches to WBLE:

The developmental approaches to WBLE lack two important considerations needed for implementing Web-based learning applications: (1) integration of the user interface design with instructional design and (2) development of the evaluation framework to improve the overall quality of Web-based learning support environments (Nam & Smith-Jackson, 2007).

On the other hand, some researchers claim that the Dick and Carey model can be used in designing WBLE and they already used it. Stokes and Terry (2004) pointed out how the course designer and developer for the non-traditional nursing students have utilized the Dick, Carey, and Carey (2002) model of instructional design as a basis for designing a pedagogically-sound course that could be delivered via an online environment to meet the needs of those nursing students.

Purpose of the Study

This study intends to discuss these conflicts concerning the use of Dick, Carey, and Carey's model⁷ in WBLE planning. Researchers involved in online learning and teaching will estimate this study as it highlights the potential specifications of using the systems approach in WBLE planning.

⁷ The considered edition in this study is the sixth which is built upon the foundation of previous editions (Dick, et al., 2005).

Furthermore, the study seeks to find out how practically the designers would make use of what normally works and how most developmental approaches have been adapted in some specific stages to correspond with new environments of learning.

Web-Based Instruction

Moving from traditional to non-traditional learning (e.g., WBLE) has not made the learning design process lose its main components. Simmons (2004) has indicated that an effective Web-based Instruction (WBI) design contains the same basic elements required for more traditional instructional design. The next paragraphs discuss the systems design model and other models involved in the planning of WBLE.

Instructional Systems Design Models

Instructional Systems Design Models are the systematic guidelines instructional designers follow in order to create a workshop, course, curriculum, an instructional program, a training session, or the instructional materials and products for educational programs. Dorin, Demmin, and Gabel (1990) looked at a model as a mental picture that helps us understand something we cannot see or experience directly. In 1975, Florida State University developed the ADDIE model of Analysis, Design, Development, Implementation, and Evaluation, which was selected by the Armed Services as the primary means for developing training. Most of the subsequent models of instructional system design viewed in literature generally involve setting goals and objectives, analyzing resources, devising a plan of action and continuous evaluation/modification of the course/program (Saettler, 1990).

The Dick and Carey instructional model was developed in 1978. The model focused on a systematic approach to designing instruction. It has an iterative process that starts by identifying instructional goals and ends with summative evaluation. Later on, Dick, Carey and Carey (2001) elaborated the Dick and Carey (1978-1996) model for instructional design that became widely known and utilized sharing common attributes in addition to recent trends in education including constructivism. The last update of this model can be seen in Figure 1.

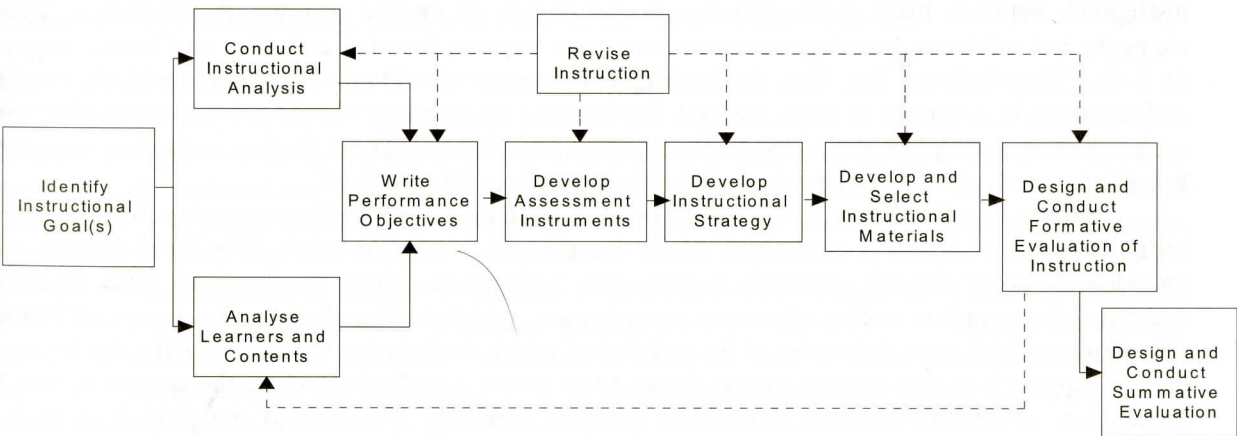


Figure 1. The Dick, Carey and Carey (2005, pp. 14-15) model

The boxes in Figure 1 represent the set of theories, procedures, and techniques employed by the instructional designer to design, develop, evaluate, and revise instruction.

Web-based Learning Environments (WBLE)

Web-based learning environment (WBLE) is a hypermedia environment consisting of networked computer applications that enables learners to learn by distance. Learners have the opportunity to be

physically separated from teachers and from each other, and they have the opportunity to participate in the learning environment at their convenience.

Methods of Planning Web-Based Learning Environment

WBLE is still an emerging learning delivery medium in this rapidly changing era of learning and teaching discipline. Too many design theories were involved in planning WBLE. However, review of the instructional design literature showed that elements of the design of WBLE were common (Carr-Chellman & Duchastel, 2000; Chou, 2003; Fisher, 2000; Harrison & Bergen, 2000; Weston & Barker, 2001). For instance, Chellman and Duchastel (2000) argued that the design of on-line learning environments should consider “the full spectrum of design, including both content and technology elements” (p. 229). They clarify that content elements are the basic instructional design elements (e.g., content, objectives and evaluation) and the technology elements are the medium-related features that support learning (e.g., interaction mechanisms, management elements and interactive Web-based elements). Zielinski (2000) emphasized that for an effective development of the Internet- or web-based learning environments, we have to consider three elements: the technology, course design, and the learning environment. Other researchers put foundations for WBLE. Davidson-Shivers and Rasmussen (2006) argued that there are three foundations of Web-based instructional design: learning, systems, and communication theories. With learning, they tend to integrate principles from each of the three main theoretical perspectives on learning, behaviorism, cognitivism, and most recently, constructivism. With systems theory, they refuted that the systematic development of instruction enables a logical plan that permits the design and development of effective instruction. Finally, with communication theory, Davidson-Shivers and Rasmussen defend that the main principles drawn from communication theory are those associated with message design.

Though researchers acknowledged that there are three schools of thought, which have been widely used and explored to provide guidance for instructional practice: behaviorism, cognitive psychology and constructivism (Villalba & Romiszowski, 2001), some researchers, however, advocate one theory over others, specifically in the WBLE field (Hung, 2001; Hung & Nichani, 2001; Oliver, 1999).

Based on the notion of constructivism, Oliver (1999) described a framework to identify and distinguish between three main elements in the design of on-line learning environments. These elements that influence learning outcomes are course content, learning activities and learner support (p. 243). Oliver believes that, first, the learning environment should provide learners with the content and resources in a variety of ways. Second, the learning environment should provide the learner with such activities and opportunities for “reflection and articulation”. Third, learner support is necessary to guide learners, provide assistance during learning and provide feedback.

Oliver and Blanksby (2003) argued that the learning resources (the content) within an online setting tend to sit across a continuum where the content is seen to move from fixed content and knowledge spaces through authentic content and information. Next, the learning tasks (learning activities) in an online setting sit across a continuum, which is described by the degree of learner autonomy, and the open-endedness of the tasks upon which the learning is based. Finally, the forms of learner support in online settings can be shown to sit across a continuum where the support is seen to move from structured feedback through to learning scaffolds. The role of the teacher in such a learning support tends to be a coach and facilitator (pp. 107-109). Apparently, Oliver introduces a learning and design strategy for WBLE. Mishra (2002) has adapted aspects of Oliver’s framework and developed an advanced design framework where the three learning theories and their basic instructional approaches have been used (see Figure 2).

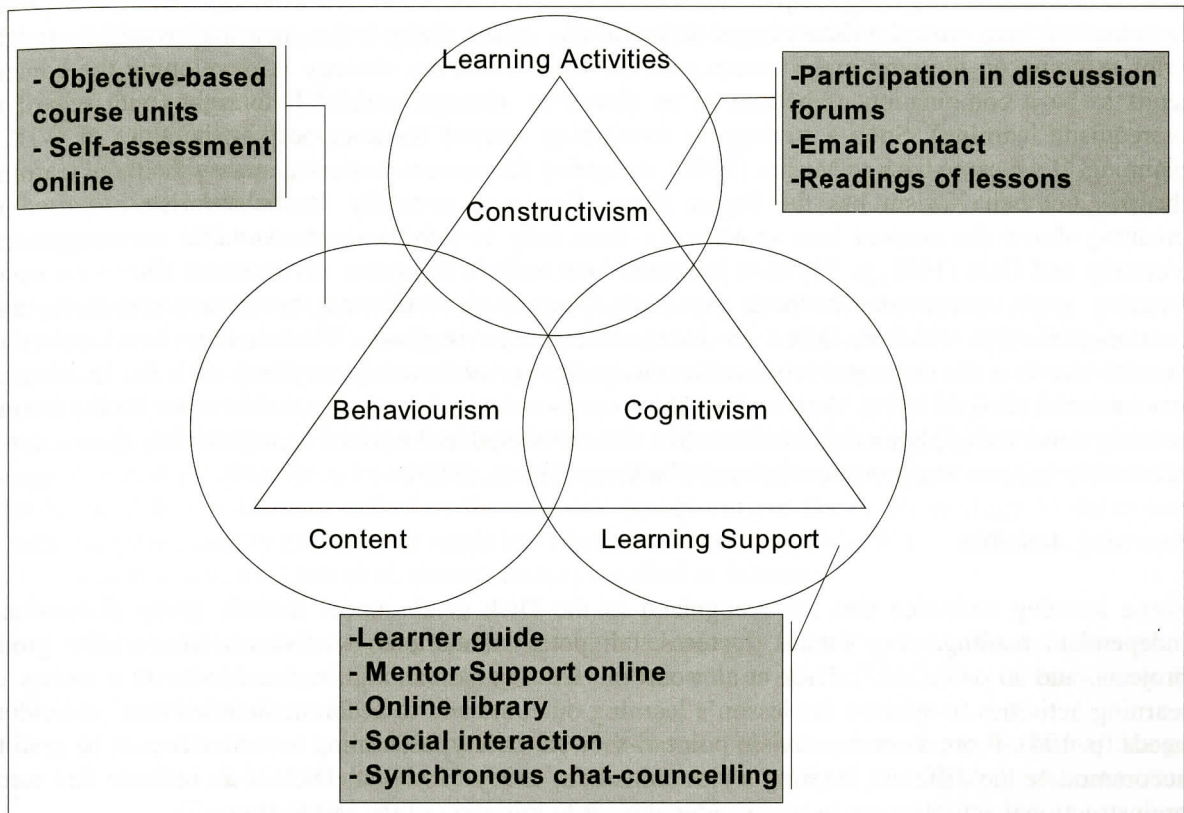


Figure 2. Design framework for online learning environment (Mishra, 2002)

Mishra divides the roles of learning theories (the behaviorism, cognitivism, and constructivism) over the content, learning support, and learning activities respectively, in such a way putting a secondary and primary role over each theory. Practically, Mishra acknowledges the necessity for an adapted framework for WBLE planning which makes use of the three learning theories.

Discussion

As seen in Figure 1, the instructional design and developmental strategy by Dick et al. starts by identifying the instructional goals, then conducting the instructional analysis (that is to determine step-by-step what people are doing when they perform those goals), parallel to analyzing the learners, the context in which they will learn the skills, and the context in which they will use them, followed by writing of performance objectives. After that, development of assessment instruments is conducted to evaluate learners' progress and instructional quality, then, the next step is to identify the strategy that will achieve the terminal objectives. After that the designer will use the instructional strategy that was developed to produce the instruction. Following the completion of a draft of the instruction, a formative evaluation is conducted to collect data for use in identifying how to improve the instruction. Finally, revision is a final step in the design and development process. The model concludes with summative evaluation which is not a part of the design process.

Based on the previous section, three main elements are considered in planning the WBLE, which are Content, Learning Support and Learning Activities. The contributions of the Dick et al. (2005) model to those three main elements are the focus of the next paragraph.

Content

The instructional strategy by Dick et al. stresses on identifying manageable groupings of content. They suggest that the designer would begin with lower-level skills, and then progress up through the

hierarchy. Meanwhile, they emphasize that designers should always consider the “prerequisite learning” If there are subordinate capabilities for any of the major steps, then they would be taught prior to going on the next major component (p. 188). Thus, the strategy in developing the content tends to be a combination of bottom to up (lower to advanced) and left to right (with regard to prerequisite learning). Such a strategy in developing content finds support in literature of WBLE planning. If we came back to Mishra (2002), designing the content is sharing among the three learning theories but behaviorism has the bigger share. However, normally the behaviorists are used to breaking down the content into small units from easy to complex with suitable encouragement. Venezky and Osin (1991, p. 76) have indicated how today’s computer environment allows for small learning steps, immediate feedback providing positive reinforcement to correct responses, and encouragement to continue when an incorrect response is given. The strategy has support of cognitivists as well; the cognitivists acknowledge that prior learning interferes with the learning of new material (Piaget, 1977). Furthermore, the constructivists acknowledge that in order for the learner to understand and apply models of instruction that are rooted in the social constructivism theories, it is reasonable to know the premises that underlie them (Ernest, 1999).

Learning Activities

Some learning activities that are recognized in the Dick et al. model include group discussions, independent reading, case studies, lectures, computer simulations, worksheets, cooperative group projects, and so on (p. 183). Dick et al. point out that learners should be provided with a variety of learning activities to achieve the lesson’s learning outcome and to accommodate learners’ individual needs (p. 194). From a constructivism point of view, a variety of learning activities should be used to accommodate the different learning styles (Jonassen, 1999). However, Dick et al. indicate that some preinstructional activities are to be considered prior to initiation of the instruction.

Preinstructional Activities

Prior to beginning formal instruction, Dick et al. stated three factors that include motivating the learners, informing them of what they will learn, and ensuring preinstructional activities. This strategy has basis in the literature of WBLE planning. From the constructivism point of view, Oliver (2000) suggested guidelines to design WBLE. One of these guidelines is “Choose the learning activities ahead of the content” (p. 6). Oliver recommends that the designer consider the learning aims and the forms of competency that might reflect their achievement. Oliver argues that after setting the learning activities, the designer can decide what resources and content students will need to support such learning activities (p. 6).

Furthermore, from the cognitivism standpoint, Bonk and Reynolds (1997) argue that in order to promote higher order thinking on the Web, online learning must create challenging activities that enable learners to link new information to old, acquire meaningful knowledge, and use their meta-cognitive abilities.

Learning Support

Oliver (1999) has pointed to the learning support as scaffolds, structures, encouragements, motivations, assistances and connections used to support learning (pp. 1-2).

From the cognitivism point of view, the strategy of learning support should provide ways in which the learner can link new content to existing prerequisite knowledge in memory. The strategy should provide the learner with ways of organizing new skills so they can be stored along with relevant existing knowledge to facilitate recall (discussions are used for information exchange, and examples help to strengthen and solidify skills, etc.). Thus, an effective learning support must accommodate a wide variety of students with different skills, backgrounds, and cognitive learning styles (Fan & Yao, 2003).

Dick et al. adopted Gagne’s Nine Events of Instruction, which is a set of external teaching activities that support the internal processes of learning. These events are intended to promote the

transfer of knowledge or information from perception through the various stages of memory. Dick et al. have organized (rearranged) Gagne's events of instruction into five major learning components:

1. Preinstructional strategies
2. Content presentation
3. Learner participation
4. Assessment
5. Follow-through activities

With preinstructional strategies, the designer would intend to gain attention and motivate learners, describe objectives, and describe and promote recall of prerequisite skills (pp. 190-193). With content presentation, the designer would determine exactly what information, concepts, and so forth, need to be presented to the learner, choosing suitable examples for each concept (pp. 193-194). With learner participation, the designer would make use of practice with feedback (p. 194). With assessment, the designer would consider three basic tests: the entry behavior test, pretest, and posttest (pp. 194-195). Finally, with follow-through activities the designer would review the entire strategy to determine whether learner memory and transfer needs have been addressed (pp. 195-197).

The critics of the Dick et al. model can be classified as follows:

1. The model is set for designing and developing at the micro level (the level design is the planning and developing at the lesson, unit or course level) (Davidson-Shivers & Rasmussen, 2003).
2. The model has not addressed the web-based learning or how the instructional design model is affected by the use of the Internet to deliver or supplement instruction (Dargan, 2003).
3. The model has not integrated the user interface design with instructional design and has not developed an evaluation framework to improve the overall quality of Web-based learning support environments (Nam & Smith-Jackson, 2007).

Concerning Points 1 & 2

The instructional strategy by Dick et al. was not restricted to develop or select some specific materials but for any kind of learning. Therefore, Dick et al. reply on those researchers who accused them that they did not address the Web as a delivery system in their model "These features (strategies) are used to develop or select materials and plan for interactive classroom instruction, mediated instruction, distance learning using a technology such as World Wide Web, or other means...." (p. 7). So, the distance learning aspect of learning and the WWW as learning environment were considered in the Dick et al. model. Furthermore, for those who recently tend to include a computer, they will find the systems approach as an invaluable tool since "Systems approach is equally applicable to the development of simple print instruction or complex digital multimedia for distance delivery over the web." (p. 9).

Concerning Point 3

Though Dick et al. have indicated that there is a complete Course Management System (CMS) available in Blackboard and Course Compass format to support the teaching and learning process for students and teachers, the Dick et al. model indeed has not detailed many technical issues in the online learning environments. The technical and pedagogical side of planning the user interface and further use of learning activities and support in WBLE are examples of such a gap in the model. So point 3 is considered a typical technical critical point.

The Dick et al. model is indeed not focused totally on planning WBLE. Meanwhile the model is not restricted to one mode of learning. Dick et al. advocate that the model is convenient to all learning environments. "A more productive approach to e-learning and to all purposeful teaching and learning is that it is a systematic process in which every component is crucial to successful learning."

(p.1). They stated these components such as the instructor, learners, materials, instructional activities, delivery system, and learning and performance environments which are expected to interact with each other and work together to bring about the desired student learning outcomes.

The model did not rely on one unique learning theory. So Dick et al. share with other researchers in this point. They argued that “elements of behaviourist, cognitivist, and constructivist views were adopted and adapted as appropriate for the varieties of learners, learning outcomes, learning contexts, and performance contexts”(p. 4). Furthermore, they assure that systems approach can be used to design individualized instruction and group-based instruction as well.

Finally, concerning the last part of point 3 which is the missing evaluation framework. Dick et al. have proposed three basic phases of formative evaluation, namely: 1) one-to-one or clinical evaluation; 2) small- group evaluation; and 3) field trial evaluation (p. 279). However, the strange thing is that Nam and Smith-Jackson themselves indicated that the evaluation approach by Dick et al. can be used in the WBLE. The Dick and Carey (1996) evaluation approach may be the best candidate, because this approach allows different types of evaluators (e.g., experts, individual, and group of evaluators) to evaluate various aspects of the web-based learning environment (e.g., individual and group learning activities) (Nam & Smith-Jackson, 2007, p. 27). Though the Dick et al. formative evaluation still indeed needs adaptation in such a way it can encompass all effective elements in the user interface design process. One of these major elements in the user interface design is the usability.

Further Research

The adaptability process of Dick et al. is needed when planning the WBLE specifically in respect to the technical and pedagogical design of the user interface. Such adaptability is recommended to encompass the further use of better learning activity and support in these online environments.

Conclusion

Obviously, no unique learning design model is suitable for all kinds of learning environments. Some details in learning environments are more suitable to some models over others. So, the idea is not to say that this model is unable to fix some problems and maybe it is better to say that using the model is not convenient here.

Dick et al. (2005) have addressed three main reasons behind the success of the systems approach: first is the focus at the outset on what learners are to know or be able to do when the instruction is concluded. The second reason is the careful linkage between each component in the model, especially the relationship between the instructional strategy and the desired learning outcomes. Third, is that the systems approach is an empirical and replicable process (pp. 8-9).

The very conclusion of this study is that regardless of the medium of delivery, the Dick et al. model can be used effectively in WBLE planning. However, the adaptability process is preferred to take place whenever that is appropriate.

References

- Bonk, C. J., & Reynolds, T. H. (1997). Learner-centered Web instruction for higher-order thinking, teamwork, and apprenticeship. In B. H. Khan (Ed.), *Web-based instruction* (pp. 167-178). Englewood Cliffs, NJ: Educational Technology Publications.
- Carr-Chellman, A., & Duchastel, P. (2000). The ideal online course. *British Journal of Educational Technology*, 31(3), pp. 229-241.
- Chou, C. (2003). Interactivity and interactive functions in web-based learning systems: A technical framework for designers. *British Journal of Educational Technology*, 34(3), 265-279.
- Dargan, Cherie Post. (2003). Designing online courses: Reflections from the cyber trenches. Master's thesis, University of Northern Iowa, USA.

- Davidson Shivers, G. V., & Rasmussen, K. L. (2006). *Web-based learning: Design, implementation, and evaluation*. Upper Saddle River, NJ: Prentice Hall.
- Dick, W., & Carey, L. M. (1978, 1985, 1990, 1996). *The systematic design of instruction (editions 1 through 4.)*. New York: Harper Collins.
- Dick, W., Carey, L., & Carey, J. O. (2001-2005). *The systematic design of instruction. (6th ed.)*. New York: Longman.
- Dorin, H., Demmin, P. E., & Gabel, D. (1990). *Chemistry: The study of matter* (3rd ed.). Englewood Cliffs, NJ: Prentice Hall.
- Ernest, P. (1995). *The one and the many*. In L. Steffe & J. Gale, J. (Eds.), *Constructivism in education* (pp. 459-486). Mahwah, NJ: Erlbaum.
- Fan, L., & Yao, Y. Y., (2003). Web-based Learning Support System. WI/IAT Workshop on Applications, Products and Services of Web-based Support Systems, October 2003, Halifax, Canada.
- Fisher, M. (2000). Implementation considerations for instructional design of Web-based learning environments, In B. Abbey (Ed.), *Instructional and cognitive impacts of web-based education*. London: Idea Group Publishing.
- Gagne, R. M., Briggs, L. J., & Wager, W.W. (1992). *Principles of instructional design* (4th ed.). Fort Worth, TX: Holt.
- Harrison, N., & Bergen, C. (2000). Some design strategies for developing an online course. *Educational Technology*, 40(1), 57-60.
- Hung, D., & Nichani, M. (2001). Constructivism and e-learning: Balancing between the individual and social levels of cognition. *Educational Technology*, 41(2), 40-44.
- Jonassen, D. H. (1999). Designing constructivist learning environments. In C. M. Reigeluth (Ed.), *Instructional design theories and models: A new paradigm of instructional theory* (Vol. 2, pp. 215-239). Mahwah, NJ: Erlbaum.
- Nam, C. S., & T. L. Smith-Jackson (2007). Web-based learning environment: A theory-based design process for development and evaluation. *Journal of Information Technology Education*, 6, 23-43.
- Oliver, R. (1999). Exploring strategies for online teaching and learning. *Distance Education*, 20(2), 240-254.
- Oliver, R., & Blanksby, V. (2003). Online learning designs in the training sector. In G. Crisp, D. Thiele, I. Scholten, S. Barker & J. Baron (Eds.) *Interact, integrate, impact: Proceedings of the 20th Annual Conference of ASCILITE* (pp. 364-374). Adelaide: ASCILITE.
- Saettler, P. (1990). *The evolution of American educational technology*. Englewood, CO: Libraries Unlimited.
- Stokes, S. P., & Terry, K. P. (2004, Spring). Theory into practice: The design of an online technology skills course for nontraditional nursing students. *Electronic Journal for the Integration of Technology in Education*, 3(1). Available at: <http://ejite.isu.edu>

- Weston, T., & Barker, L. (2001). Designing, implementing, and evaluating web-based learning modules for university students. *Educational Technology*, 41(4), 15-22.
- Villalba, C., & Romiszowski, A. J. (2001). Current and ideal practice in designing, developing and delivering web-based training. In B. H. Khan (Ed.) *Web-based training* (pp. 325-342). Englewood Cliffs, NJ: ETP.
- Zielinski, D. (2000). Can you keep learners online? *Training*, 37(3), 64-75.